

CONN CTIONS

DOD

Æζ

DEPARTMENT of ELECTRICAL & COMPUTER ENGINEERING

A. JAMES CLARK SCHOOL of ENGINEERING

1 3:38 Harry

ffiliates

AC

leidos

Agilent Technologies

HUGHES

parc

www.ece.umd.edu

Cyberpoint

THALES

Via

Booz | Allen | Hamilton

TATA

TATA CONSULTANCY SERVICES

KEYSIGH

DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERINC

celebrates the leadership and meritorious contributions of

the area of visible and ultraviolet lasers and ultrafast laser spectroscopy.

ECE DISTINGUISHED ALUMNI A ACD 2016 TN TH

INNOVATIONS

Appian

FALL 2016 Vol. 22 No. 1

INNOVATIONS

AEROSPACE

KEYW

NORTHROP GRUMMAN

TENABLE

TEXAS INSTRUMENTS

cādence

UNIVERSITY OF MARYLAND / FEARLESS IDEAS

CONTENT FALL 2016 Vol. 22 No. 1

HIGHLIGHT	05
What's Cool About ECE? Everything	
FEATURE STORY	06
Innovations of ECI	
FACULTY NEWS	10
Awards and Honors for ECE Facult	
RESEARCH NEWS	14
Researchers at UMD Make Breakthrough in Terahertz Technology	
STUDENT NEWS	16
Awards and Honors for ECE Student	
ALUMNI NEWS	18
ECE Inducts Five New Distinguished Alumn	
DONOR SPOTLIGHT	22
ViaSat & Circuits Design Lab Renamed in Honor of Beloved Professo	



message from the chair

I have had the privilege of serving as chairman of the Department of Electrical and Computer Engineering (ECE) at the University of Maryland, College Park, for five academic years, and every year, I have been more and more inspired by the enthusiasm of the graduates of the department, the research done by our faculty and researchers, and the dedication of our staff. While traditional electrical and computer engineering will always be the core of our mission, the fresh perspectives of our faculty members, alumni, and students are changing our classrooms, our research, and how we impact the state, the country and the world.

ECE is a department with a broad and wide-ranging reach. With nearly 60 tenured/tenure track professors, we are able to endow our students with deep knowledge of such subjects as computer security and architecture, optics and quantum computing, microelectronics and power, communications, signal processing and machine learning, control systems, and robotics, just to name a few. Our professors are first-class educators who care deeply about their students and their success. We strive to keep our curriculum dynamic, with constant improvements and adjustments to our courses in order to keep them fresh, relevant, and current.

Academics, however, is just one area in which our faculty excel. Their research is on the cutting edge of technology, and it is used to tackle far-reaching societal problems and issues. For these reasons, we are pleased to feature some of our outstanding professors in this issue of Connections. In these pages, you will read about four professors who are making huge strides through their research, as well as some of the accomplishments of our other faculty. We are especially proud of four assistant professors, Behtash Babadi, Jeremy Munday, Michael Rotkowitz, and Dana Dachman-Soled, who have won National Science Foundation Career Awards, and an assistant professor, Mohammad Hafezi, who won the SLOAN Fellowship and the Young Investigator Award from the Office of Naval Research. These achievements show how the caliber of our research has grown in our department, and how brightly the future of ECE is shining.

Investing in the best faculty also represents our heavy investment in our students. Last year, you read about the upcoming, brand-new freshman course, "What's Cool About ECE?" This course, which was conducted through the collaboration with eight ECE faculty members with the lab sponsored by Texas Instruments, was hugely popular among our freshman students. I thank the Associate Chair, Professor Mel Gomez for his enthusiasm and leadership in getting this course and lab going, the staff of Technical Operations Unit led by Mr. Bryan Quinn for building the lab and the staff of External Relations Unit led by Ms. Amanda Stein for serving as a conduit between the department and TI. Its success was thrilling for all of us in ECE. This fall, we will unveil the newly designed ENEE307 Circuits Design Lab, a class previously taught by the late Professor Jimmy H.C. Lin. The redesign was made possible through a generous donation from friends and family of Lin.

In the coming year, I hope to see ECE grow even more. I would love to hear from you and hope I can count on your support. It is my sincerest hope that you will take the opportunity to help ECE in whatever way is most meaningful to you—anything from supporting current research to lab improvements to education tor extracurricular activities. The time, expertise, and financial support of out alumni, whether personal or through industry sponsorship, are crucial to the success of our program. To learn more about our department or to discuss any of the subjects outlined in Connections, please contact our Director of External Relations, Amanda Stein, at steina@umd.edu. Thank you for supporting our department.

Rama Chellappa

ama

MINTA MARTIN PROFESSOR OF ENGINEERING

Chellappa

ARTIN SOR OF ERING

CONNECTIONS is published for alumni and friends of the Department of Electrical and Computer Engineering at the A. James Clark School of Engineering, University of Maryland, College Park. Your alumni news and comments are welcome. Please send them to: Amanda Stein, Director of External Relations in ECE, 2453 A.V. Williams Building, College Park, MD, 20742 or steina@umd.edu.

Visit our website at: www.ece.umd.edu

Department Chair: Dr. Rama Chellappa | Writer: Shana Hattis | Editor: Amanda Stein, Kara Stamets | Graphic Design: Jennifer Apple Photography: Carrie Hilmer, Bryan Quinn, Amanda Stein, Al Santos, Kara Stamets

the 2015-2016 graduating class

DATA ON THE **TOTAL GRADUATING GRADUATING CLASS SENIORS: 157** IN FALL 2015 AND 42 graduated in the fall 115 graduated in the spring **SPRING 2016:** 81 students (51%) were in either College Park Scholars or University Honors COMPUTER ENGINEERING 93% employed or in graduate school (90% employed, 3% grad school) **TOP EMPLOYERS FOR CE:** Amazon AVERAGE STARTING Booz Allen Hamilton SALARY Google \$90,000 (highest in Clark) Microsoft Northrop Grumman ELECTRICAL ENGINEERING 85% employed or in graduate school (72% employed, 13% grad school) **TOP EMPLOYERS FOR EE:** Hughes Network Systems **AVERAGE STARTING** Northrop Grumman SALARY Texas İnstruments \$73,800 Booz Allen Hamilton (2nd highest in Clark) Boeing

Follow Up: *"What's Cool About ECE?"* Everything!





It was a banner year in 2015 for the Department of Electrical and Computer Engineering and its faculty, due in no small part to the introduction of a new, first-year course: "What's Cool in ECE?," officially known as ENEE 101.

ENEE 101, which will continue to be offered each semester, was the result of research showing that electrical and computer engineering students desired to give more context to their studies and to their future careers. In order to meet this demand, ECE faculty created and conceptualized ENEE 101 as an experiential, modular course. During each of the 15 weeks, students listen to a 75-minute lecture and spend a total of 4 hours in the Texas Instruments Design Lab (a collaboration between ECE and Texas Instruments). Topics cover the core highlights of the ECE curriculum, including circuits, electromagnetic spectra and waves, feedback controls, image and signal processing, microcontrollers and mobile computing, Unix and software engineering, power, and ethics. Because the course is only one semester in length, the pace is vigorous and the range of material is intense.

Student reaction to the course has been strongly positive. This evaluation has given concrete evidence that the department is likely to increase its retention rates as students learn more about the scope of their majors. Comments from those who participated in the initial course reflected this sense of excitement. "The guest lectures once a week were a thrill to watch because there were

so many talented professors brought in who could share their experience and research with us in an involved and open-toquestions atmosphere. I highly enjoyed this class and only wish I could retake it," wrote one student in the end-of-course evaluations.

"This was one of my favorite classes so far," said another student. "I was able to learn a lot and practice what was taught. I was also able to hear from people working in the field and figure out what electrical engineers really do outside of college."

And It's not only the freshmen students who have benefitted from this new course. While working closely with faculty members, the undergraduate teaching fellows (students who run the dayto-day lab operations) have seized this opportunity to develop their technical proficiency, communication skills, and leadership methods. The fellows, chosen from the ranks of high-performing students in the upper-level cohorts, are able to use their roles to further contextualize their own coursework. Active collaboration with the faculty is highly desired; the fellows are encouraged to suggest revisions to the ENEE 101 material to make it even more accessible to the younger students.

ECE Research Paves the Way for Big Innovations in Technology

Professors in the Department of Electrical and Computer Engineering wear many hats: scholars, teachers, and researchers, always working to stay on the cutting edge of technology. This year, **Alireza Khaligh**, **Christopher Davis**, **Min Wu**, and **Joseph JaJa** have brought exciting new ideas to the table, on subjects ranging from baseball to power electronics.

Alireza Khaligh: Integrated Onboard Charger and Auxiliary Load Converter for Electric Vehicles

Alireza Khaligh (ECE/ISR) is breaking new ground in the field of power electronics: the technology of controlling and conversion of electrical power.

"Every Electric Vehicle (EV) or Plug-In Hybrid Electric Vehicle (PHEV) has an onboard charger to charge its high voltage (HV) and high capacity battery," he said. "In addition, EVs and PHEVs are equipped with a DC/DC converter to step-down the HV battery voltage to 12 volts to power auxiliary loads, such as AC systems and stereo systems."



His invention, an integrated reduced-part 15kW level 2 charging interface for plug-in hybrid electric vehicles, is inspired by the need to reduce the cost and weight of electric vehicles while making them more efficient. This innovation integrates the



two converters and reduces their cost, weight, and volume by half. Its unique control structure allows for the efficiency of the integrated converter in both grid-to-vehicle (G2V) charging and vehicle-to-grid (V2G) discharging to be enhanced. It is capable of operating with a wide single phase charging voltage range including 120/220/240 VAC, and analysis has verified that a power factor above 0.995 and a THD of 4.55% can be achieved in all operating modes such as charging, motoring, and regenerative braking. Khaligh and his partners are currently working toward developing a product-level prototype for installation and verification on various electric vehicles.

"[This innovation] has applications in any EV and PHEV, from sedans to medium-duty and heavy-duty vehicles, as well as buses. It could be extended to any kind of electrified transportation vehicle," Khaligh said. "We are looking forward to validating this technology in a real vehicle."

Joseph JaJa: Uncovering Demographic Inequality in Environmental Resources

The unequal patterns for privileged access to environmental resources, and the inevitable sociodemographic inequality of those unfairly exposed to environmental toxins, are well known. However, until now, there has never been a systematic form of research to show the scope of this divide and the extent of the variations.

Joseph JaJa (ECE/UMIACS) and his team, who are investigating the health risks of over 600 chemicals released by industrial facilities in the continental United States, are deriving new insights into health risk exposures among different sociodemographic groups. This project is a coordinated effort between their team and Mary Collins and Ian Munoz at the National Socio-



Environmental Synthesis Center.

JaJa and his team use two Main data sources for their research-the EPA's Risk Screening Environmental Indicators (RSEI) from 2007 and the U.S. Census of Population and Households from 2000. Their sociodemographic information is derived from the block and blockgroup listings of the 2000 Census. The health risk corresponding to each chemical and each plant is estimated over a network of non-overlapping grid cells covering the continental U.S., each cell representing an area of 810 m2.

"We show that, although polluters are likely to disproportionally impact poor and non-white communities, these disproportionalities become more severe when considering the smaller group of facilities that produce the majority of health risks," he said. "Our analysis indicates the extreme unevenness of the toxicity levels generated by the facilities. In particular, 90 percent of toxic concentration present in the continental U.S. is generated by only 814 (5 percent of) facilities."

Min Wu: Signaling a More Secure Future

Min Wu (ECE/ISR/UMIACS) and her research team are committed to making the world a safer place for everyone. Wu's team, which works on the forensic analysis of electronic



media signals, received a patent in June for their system of environmental signatures for forensic analysis and alignment of media recordings.

The patent's abstract explains the rationale behind the research: "Various systems and methods may benefit from determination of environmental signatures in

recordings. For example, such signatures may aid forensic analysis and alignment of media recordings, such as alignment of audio or video recordings. A method can include reading data representative of sense light in a visual track of a video recording. The method can also include extracting an electric network frequency signal from the data representative of sensed light." Wu's system looks for electronic "fingerprints" that are embedded in video. These markers are a key to determining where a video was made. The implications of this technology, which relies on the "mains frequency" continuously present on the power grid, are profound: law enforcement has begun to record this electronic network frequency in order to determine whether audio recordings have been falsified or otherwise edited or changed.

Wu's work has received other accolades as well. In 2015, she, along with her team, won the UMD Invention of the Year award. In 2012, she received the same award for her work in pinpointing locations and times of digital recordings; this system can help others detect tampering.

Christopher Davis: Hitting a Home Run with New Sports Technology

Christopher Davis (ECE) and his research group are paving the way toward making baseball a more enjoyable experience for fans and umpires alike with their electronic home plate.

Their innovation, which works for both baseball and softball, uses optical techniques to measure the height and lateral position of a ball as it crosses the plate, automatically determining whether it is a ball or a strike. Their system uses vertical infrared curtains of light from light emitting diodes (LEDs), which shine up from the plate. The ball



scatters some of this light to detectors embedded in the plate, providing all the information about the pitch. The plate also measures the speed and trajectory of the ball and monitors unchecked swings by the batter.

The electronic home plate is designed to relieve some of the stress

on umpires. "No other technology can do what our electronic home plate does, except million-dollar camera systems only affordable by Major League Baseball," said Davis. "If used in youth baseball, the electronic home plate could assist inexperienced umpires in calling balls and strikes. This builds on the research expertise in our laboratory, which involves research on a host of advanced optical systems."

Davis intends to have the device marketed initially as a tool for pitcher training and evaluation and for game play in situations lacking umpires at the home plate. Later on, the hope is for it to be used in youth baseball to help umpires call balls and strikes. The device will be "ruggedized" for outdoor, real-world use and is intended to be priced affordably.

Some of the other research being conducted by Davis's laboratory includes remote sensing, laser weapons, and free space optical communications.



ECE Looks to a Promising Future for Its Junior Faculty

Six faculty members from the A. James Clark School of Engineering received awards from the National Science Foundation, including the highly competitive Faculty Early Career Development (CAREER) awards, in 2014, 2015, and 2016. The assistant professors who were honored include Michael Rotkowitz, Dana Dachman-Soled, Charalampos "Babis" Papamanthou, Tudor Dumitras, Jeremy Munday, and Behtash Babadi.

An award from the CAREER program is the NSF's most prestigious distinction in support of junior faculty. Honorees are considered preeminent scholar-teachers based on the strength of their outstanding research, excellent contributions to education, and the integration of these priorities within the missions of the organizations.

Michael Rotkowitz

Michael Rotkowitz (ECE/ISR) received a 2014 CAREER award for "Decentralization and Parsimony for Implementable Control of Massively Interconnected Systems." The five-year award is worth \$400,000.



Rotkowitz's research will produce a novel synthesis of the theory and methods of parsimonious recovery, which has undergone dramatic recent developments in both the classical results and modern advances in decentralized control. It will further broaden the applicability of elegant and useful aspects

of optimization theory to classes of problems that are paramount for the main scope of the project. The fundamental advances pursued in optimization and estimation have the potential to be of use much more broadly and to impact many other fields. This project further seeks to make broad impacts outside of its primary domain through collaborations with industry and with experimentalists and through the creation of software tools for widespread use by non-experts.

Rotkowitz received a B.S. in mathematical and computational science (with honors and with distinction) from Stanford University in 1996. He worked for J.P. Morgan Investment Management in New York until 1998, when he returned to Stanford to obtain a Ph.D. in aeronautics and astronautics in 2005. During that time, he also worked for NASA Ames Research Center.

Dana Dachman-Soled

Dana Dachman-Soled (ECE/UMIACS) received her CAREER award in 2015 for Non-Black-Box Cryptography: Defending Against and Benefiting from Access to Code. The five-year award is worth \$495,000. Her research interests include cryptography, complexity theory, and security. She is also interested in



property testing of Boolean functions and cryptographic hardness of learning.

Dachman-Soled's work focuses on developing cryptosystems that remain secure even when implemented on devices that are susceptible to side-channel attacks—attacks that depend on the particular algorithm and/or the specific implementation employed such as timing or fault-injection attacks. In practice, many cryptosystems can be completely reverse engineered via such attacks. Her approach is to develop new cryptosystems that offer provable security against large classes of side-channel attacks, potentially even against attacks that are not yet known.

"This grant will allow me to support and develop my research and educational agenda," she said. "I am looking forward to using this opportunity to make an impact in my field."

Prior to joining the University of Maryland, Dachman-Soled spent two years at Microsoft Research New England. She completed her Ph.D. at Columbia University in 2011 under the supervision of Tal Malkin.

Charalampos "Babis" Papamanthou

Charalampos "Babis" Papamanthou (ECE/UMIACS/MC2) was awarded a \$500,000 National Science Foundation (NSF) grant on advanced data structures and security.

The project aims to fulfill two objectives, says Papamanthou: the first is to develop new techniques for ensuring authenticity of data structures maintained on a remote server, including both the elements of the dataset as well as their interrelationships (e.g., links between pairs of nodes in a social network).



The second is to develop new data structures to improve the efficiency of algorithms for security and privacy applications. Research will encompass algorithm design, theoretical analysis, rigorous proofs of correctness, and experimental validation of claims of practicality. New discoveries by Papamanthou and others could have applications to a broad range of online services used by businesses and consumers, such as authenticating data in outsourced documents like Google Docs and Gmail services and allowing users to perform searches over encrypted e-mails.

In 2015, Papamanthou also received a \$12,000 award from Yahoo! Labs to develop new algorithms for searchable encryption that will make it easier for users to navigate end-to-end secure email and a \$50,000 grant from Google to similarly pursue research to make it easier for users to navigate e-mail encryption.

Tudor Dumitras

Tudor Dumitras (ECE/UMIACS/Maryland Cybersecurity Center) has received a National Science Foundation (NSF) award to study how well software updating mechanisms work. The two-year award for approximately \$175,000 is part of the NSF's Secure and Trustworthy Cyberspace (SaTC) program.



The research funded by the SaTC grant will look at the "timeliness" of organizations protecting their cyber infrastructure with security patches. In order to prevent cyber attacks, security updates should be installed as soon as the software vendor releases them, Dumitras says. But often there are times when—for a variety of reasons updates are not applied in a timely manner, giving

cybercriminals the opportunity to exploit a system. Dumitras, working with second-year electrical and computer engineering doctoral student Ziyun Zhu, will use the SaTC funding to conduct research that examines how quickly software updates are deployed on millions of hosts around the world, as well as the reasons behind updating delays.

Dumitras received a B.S. in computer science from Politechnica University in Bucharest, Romania. He received his M.S. and Ph.D. in computer science from Carnegie Mellon University and holds a diplôme d'ingénieur in computer science from Ecole Polytechnique in Paris, France.

Jeremy Munday

Jeremy Munday (ECE/IREAP) received his CAREER award in 2016 for his work in improving the functionality of plasmonic devices

while simultaneously increasing access to alternative energy education. The award amount is approximately \$500,000.



Nearly all modern technology involves the interaction of light with electronic circuitry in order to perform specific functions. When light is absorbed in a device, it can create electrons

with more energy than needed to execute the desired function (hotelectrons). Munday's goals are first to advance the understanding of these hot-electrons, and secondly, to integrate the research into education by creating a suite of online learning tools for dissemination of ideas and techniques in alternative energy. These findings will be applied to problems of global importance, such as solar energy generation and wireless communication.

Munday also won the prestigious Adolph Lomb Medal in 2015 from The Optical Society of America and was featured in their Centennial booklet titled "Sparking Inspiration." The Lomb Medal is presented annually to individuals who have made noteworthy contributions to optics before the age of 35. He earned the Lomb Medal for his innovative experimental and theoretical work on plasmonic and photonic light-trapping in solar cells.

Munday received his Ph.D. in physics from Harvard in 2008 and his B.S. in physics from Middle Tennessee State University in 2003. He did a postdoctoral at Caltech and came to the University of Maryland in 2011.

Behtash Babadi

Behtash Babadi (ECE/ISR) received the CAREER award in 2016 for "Deciphering Brain Function Through Dynamic Sparse Signal Processing." The project's main objective is to develop a mathematically principled methodology that captures the dynamicity and sparsity of neural data in a scalable fashion with high accuracy and to employ it in studying the brain function with a focus on the auditory system. The five-year award is worth \$489,813.

Hafezi Receives Prestigious 2015 Sloan Fellowship

Mohammad Hafezi (ECE/IREAP), Joint Quantum Institute Fellow, has been awarded a prestigious Sloan Research Fellowship. Granted by the Alfred P. Sloan Foundation, this award selects 126 early-career scientists based on their potential to contribute fundamentally significant research to a wider academic community.

Each 2015 Sloan Research Fellow is awarded a two-year \$50,000 grant to support their research interests. Hafezi's research interests include the theoretical and experimental investigation of strongly correlated systems and topological physics, nanophotonics and optomechanics, and hybrid quantum systems.

The fellowships are awarded in eight scientific and technical fields. Candidates must be nominated by their fellow scientists. Winning fellows are selected by an independent panel of senior scholars on the basis of a candidate's independent research accomplishments, creativity, and potential to become a leader is hit.

and potential to become a leader in his or her field.

"Looking at the list of luminaries who have been given this award in the past, I am very humbled," said Hafezi.

Since the beginning of the program, 43 fellows have received a Nobel Prize in their respective fields, 16 have won the Fields Medal in mathematics, 65 have received the National Medal of Science, and 14 have won the John Bates Clark Medal in economics, including every winner since 2007.



Thanks to advances in neural data acquisition technology, the process of data collection has been substantially facilitated, resulting in abundant pools of high-dimensional, dynamic, and complex data under various modalities and conditions from the nervous systems of animals and humans. The current modeling paradigm and estimation algorithms, however, face challenges in processing these data. Babadi's research addresses these challenges by providing a unified framework



to efficiently utilize the abundant pools of data in order to deliver game-changing applications in systems neuroscience.

Babadi joined the Department of Electrical and Computer Engineering in January 2014 after finishing his post-doctoral fellowship at MIT and Massachusetts

General Hospital in systems neuroscience. He received his Ph.D. in Engineering Science from Harvard in 2011. His research interests are in statistical and adaptive signal processing, neural signal processing, and systems neuroscience.

9

Awards and Honors for ECE Faculty

Alexander Barg receives NSF grant to study theoretic aspects of local data recovery

A three-year, \$250,000 National Science Foundation Computing and Communication Foundations grant has been awarded to ECE/ISR Professor **Alexander Barg** for his work on "Coding and Information: Theoretic Aspects of Local Data Recovery."

Barg will study fundamental problems in data coding and work to improve the efficiency of distributed storage systems by increasing data reliability and availability while reducing storage overhead compared to existing industry standards. This research will benefit storage applications ranging from financial, scientific,



monitoring, and signal processing endeavors to social networks and sharing platforms. The coding schemes developed in this project will be validated through implementation and evaluation in a simulated computer environment.

UMD Startup Makes Strides in Cybersecurity

One of the greatest threats to personal and national security today is malware, and Professor of Electrical and Computer Engineering **Rajeev Barua** and his researchers are working to eradicate this problem for good.



Barua began researching malware detection in 2014 after realizing his work in program analysis could be applied to cybersecurity. That same year, he founded SecondWrite. The company's software forces evasive malware to behave as it would in a live system, making it easier to detect and stop.

To date, SecondWrite has raised nearly \$1.5 million from sources such as the National Science Foundation's Small Business Innovative Research (SBIR) program, Maryland's Technology Development Corporation, and private donors. It is also a member of the National Science Foundation's Innovation Corps (I-Corps) program and a University of Maryland incubator company through the Maryland Technology Enterprise Institute (Mtech), which provides support and guidance for entrepreneurs at UMD.

Khaligh Realizes Success at the 2016 IEEE APEC Conference

Associate Professor **Alireza Khaligh** (ECE/ISR) served as the General Chair of the 2016 IEEE Applied Power Electronics Conference and Exposition (APEC). The conference was held in Long Beach, California, from March 20 to 24, 2016.

APEC is the premier event for practicing power electronics professionals, drawing a record high over 5,300 participants. Its program addressed a broad range of topics in the use, design, manufacturing and marketing of all kinds of power electronics systems. Highlights included a full program of highly selective refereed technical papers, unique plenary



presentations featuring distinguished world-class leaders from industry and academia, the largest power electronics exposition with representations from 268 companies, a unique industry presentation seminar series, an interesting rap session program, and a one-of-a-kind international micromouse competition.

Former ECE Chair Named President of the University of College Cork in Ireland

Patrick O'Shea (ECE), former chair of Electrical and Computer Engineering and current vice president and chief research officer of the University of Maryland, has been appointed president of The University College Cork in Cork, Ireland.



O'Shea, a native of Cork and a

UCC alumnus, was the ECE chair from 2005 to 2011. In his vice presidential role, he has overseen the growth of UMD's research enterprise to a record \$550 million in external research awards. He also has served as a professor with multiple appointments, including the Institute for Research in Electronics and Applied Physics (IREAP), Physics, the Maryland NanoCenter and the University of Maryland Energy Research Center (UMERC). O'Shea joined the faculty of ECE in 1998 and was named a UMD Distinguished Scholar-Teacher in 2009.

O'Shea's areas of expertise are applied electromagnetics, nonlinear dynamics, and charge particle bean technology and applications.



Ulukus Named a 2016–2017 Distinguished Scholar-Teacher by the University of Maryland

Sennur Ulukus (ECE/ISR) has received the highly coveted honor of a 2016-2017 Distinguished Scholar-Teacher from the University of Maryland. She is one of only four UMD professors to receive the honor

this year. The Distinguished Scholar-Teacher Program recognizes faculty members who have demonstrated outstanding scholarly achievement alongside outstanding accomplishments as teachers. Nominees for the award are named by their peers, and the winners are chosen by a panel of former Distinguished Scholar-Teachers. She is the 12th ECE professor to be honored in this fashion.

Ulukus is an IEEE fellow whose research interests are in wireless communications, information theory, signal processing, networking, information theoretic physical layer security, and energy harvesting communications. She has received numerous awards, including the 2003 IEEE Marconi Prize Paper Award in Wireless Communications, a 2005 NSF CAREER Award, the 2010-2011 ISR Outstanding Systems Engineering Faculty Award, and the 2012 George Corcoran Education Award. Her publication experience includes stints as associate editor for *IEEE Transactions on Information Theory* (2007-2010) and *IEEE Transactions on Communications* (2003-2007). Ulukus served as a guest editor for the special issue of the *IEEE Journal on Selected Areas in Communications* on wireless communications powered by energy harvesting and wireless energy transfer (2015), the special issue of the *Journal of Communications and Networks* on energy harvesting in wireless networks (2012), the special issue of the *IEEE Transactions on Information Theory Journal* on interference networks (2011), and the special issue of the *IEEE Journal on Selected Areas in Communications* on multiuser detection for advanced communication systems and networks (2008).

She was the Secretary of the IEEE Communication Theory Technical Committee (CTTC) from 2007 to 2009 and has served as the TPC co-chair of several conferences, including the 2014 IEEE PIMRC, the Communication Theory Symposium at 2014 IEEE Globecom, and the Energy Harvesting and Green Wireless Communications Symposium at 2013 GlobalSIP.



ECE Professor Thomas Antonsen Recognized by IEEE for Contributions to Vacuum Electronics

Thomas M. Antonsen, Jr., (ECE/IREAP/ Physics) received the 2016 John R. Pierce Award for Excellence in Vacuum Electronics at the Plenary Session of the International Vacuum Electronics Conference on April 19, 2016, in Monterey, California. Established in 2002, the Pierce Award is given annually by

the IEEE Electron Devices Society (EDS) Technical Committee on Vacuum Devices and is widely recognized as the highest honor in the field.

According to the award citation, Antonsen was honored "for contributions to the theory of charged particle beam generation and the development of computational design tools for fast and slow wave devices." Vacuum electronics predate transistors and were used in many early versions of technologies such as TV and radio. Though solid-state electronics have replaced vacuum tubes in almost all applications, vacuum electronic devices are still state-of-the-art technology in satellite communications, radar, and other applications that require high power, high efficiency, or high frequency. Antonsen's contributions to the field most notably include the development of the software programs MAGY, CHRISTINE 1D and 3D, and TESLA, which simulate the performance of a variety of microwave and millimeter wave sources. MAGY, TESLA, and CHRISTINE are used widely by other researchers and by national industry to design and optimize products. An example includes the final transmitter amplifier on NASA's Lunar Reconnaissance Orbiter (LRO), which was designed using the CHRISTINE codes.

"Antonsen is one of the leading plasma physics theoreticians in the world," said Baruch Levush of the Electronics Science & Technology Division at the Naval Research Laboratory and 2007 Pierce awardee. "The U.S. vacuum electronics community is fortunate that [he] applied his supreme ability of theoretical and numerical analysis towards modeling of vacuum electron devices, such as gyrotrons, klystrons, and traveling wave tubes."

His software is also a legacy within his family: MAGY and CHRISTINE were named for his two daughters.

Chellappa Named Distinguished University Professor

Rama Chellappa, chair of the A. James Clark School of Engineering's Department of Electrical and Computer Engineering and Minta Martin professor of engineering, has been named a University of Maryland distinguished university professor, the most prestigious internal honor on the campus. Fewer than 65 active



professors have received this designation, and Chellappa is 1 of 9 faculty members who will be honored at the convention this fall.

"[Rama's] dedication toward research, scholarship and service is evident in almost everything we do," says Amitabh Varshney, professor of computer science and director of the University of Maryland Institute for Advanced Computer Studies (UMIACS).

Chellappa's research includes signal and image processing, computer vision, pattern recognition, and machine intelligence. In 2016, he led a UMIACS team that won the information science category of the University of Maryland's Invention of the Year competition. Honors awarded outside of UMD include fellowships in six professional organizations (AAAI, AAAS, ACM, IAPR, IEEE, and OSA), the K.S. Fu Prize, Society, Technical Achievement and Meritorious Service Awards from the IEEE Signal Processing Society and Technical Achievement and Meritorious Service Awards from the IEEE Computer Society.

Faculty Spotlight: John Baras

John S. Baras (ECE/ISR), the Lockheed Martin Chair in Systems Engineering and the founding director of the Institute for Systems Research, has recently been honored by several awards: being named a National Academy of Inventors (NAI) Fellow and an International Federation for Automatic Control (IFAC) Fellow, as well as an induction into the A. James Clark School of Engineering's Innovation Hall of Fame (IHOF).

Baras was chosen as a 2015 NAI Fellow for demonstrating "a highly prolific spirit of innovation in creating or facilitating outstanding inventions that have made a tangible impact on quality of life, economic development, and the welfare of society." By 2015, Baras held 15 patents and a software copyright. His most significant patents and copyright focused on the pioneering development of the Internet over satellite protocols and related security schemes. His patent on CELP speech compression broke every existing record, at the time, for high quality and reduced complexity compression, while his patent on video compression provided superior compression by incorporating a model of the human eye. His seven patents on wireless devices security promise to revolutionize the security of smart phones, tablets, and laptops by combining biometrics, signal processing, and physical hardware characteristics.

Baras' selection as IFAC Fellow was based on his accomplishments in systems and control. His contributions include pioneering development of robust (H-infinity) control of partially observed nonlinear systems (including set-valued ones) with superior performance applications to chemical and semiconductor manufacturing process control; seminal contributions to nonlinear filtering, nonlinear observers, and heterogeneous sensor scheduling; a new, simple derivation of the partially observed stochastic minimum principle; the earliest ever results on adaptive control of queues; modeling and control of hysteresis for magnetostrictive actuators; novel architectures, Gibbs-sampler algorithms, learning collaboration, and simple "system optimal" distributed algorithms for multi-agent systems cooperative control; and novel semiring models for trust evaluation in dynamic networks, linked to constrained coalitional games, showing the catalytic role of trust for collaboration.

IHOF inductees, who are chosen from UMD faculty and alumni, are selected for their achievements in innovation and contributions to advancing the understanding of the engineering profession. Baras is being inducted in 2016 for his outstanding contributions to Internet over satellite technology and hybrid networks, which have enabled broadband Internet services over interoperable satellite and terrestrial networks. Baras created algorithms and protocols by which Internet services can be delivered over satellite, beginning with the introduction and demonstration of the first working broadband Internet over satellite protocol in 1994. When the new Internet over satellite technology was introduced in 1994, it was much faster than the fastest available broadband for consumers.

Baras' research was performed under the Center for Satellite and Hybrid Communication Networks (CSHCN), which Baras co-founded with his colleague Anthony Ephremides in 1992. Since he foresaw the explosion in Internet use over communication networks of all types, Baras focused his CSHCN work on the key challenge of developing broadband Internet over hybrid networks. Baras' specific initial solution emerged from the framework of his joint work with Ephremides and their students, which was recognized by an Outstanding Invention of the Year Award from the Office of Technology Liaison of the University of Maryland in 1994. Baras' initial innovation involved: (i) "splitting the connection"; (ii) "address spoofing"; and (iii) "selective acknowledgment."



that the delay in receiving an acknowledgment of a request was actually due to the satellite physical path delay and not due to congestion (which the TCP protocol is designed to assume).

To ensure that Internet over satellite technology would remain a competitive alternative to terrestrial Internet technologies, and to overcome the limitations of the initial asymmetric design, Baras continued this research effort in the ensuing years (1993-present). With his students, he developed several important innovations and was granted several patents, targeting such issues as: fast Internet service to broadband wireless LANs connected to a satellite; efficient and adaptive hybrid (multicast and unicast) data delivery systems; secure and scalable two-way broadband satellite Internet services; acceleration schemes for broadband two-way satellite Internet services; Layered Encryption Security resulting in the Layered IPSEC International Standard; new lightweight symmetrickey digital certificates and a source authentication protocol for group communication in hybrid networks; and extensions to space communications, including Internet service to planes, to the International Space Station and communications between Earth and expedition teams on the moon.

Baras' results were implemented progressively over time, in a longterm (1993–2004), successful collaboration with Hughes Network Systems (HNS) engineers in several HNS award winning products culminating with HughesNet[®], which became the company's largest single business. Baras' contributions and innovations were essential to the creation of the industry sector for Internet services over satellite, serving consumers, businesses, ships and aircraft, remote oil rigs, military networks, and facilitating telemedicine services, environmental information, and emergency and disaster relief. Today many companies provide such services and products, with billions of dollars in sales, tens of millions of users and broad societal impact. Learn more at go.umd.edu/Baras-IHOF.

Baras received his B.S. in electrical and mechanical engineering from the National Technical University of Athens in 1970 and his M.S. and Ph.D. in applied mathematics from Harvard University in 1971 and 1973. He joined UMD in August 1973 and is a faculty member in both ECE and ISR. Baras was the founding director of ISR from 1985 to 1991. He was appointed to the Lockheed Martin Chair in 1990. In 1992, he served as the founding Co-director with professor Ephremides of the Maryland Hybrid Networks Center (HyNet), an industry/university/government consortium for hybrid wireless networks supported by the Department of Defense, NASA, and industry. He is a foreign member of the Royal Swedish Academy of Engineering Sciences (IVA), and a Fellow of IEEE, SIAM, AAAS, NAI, and IFAC. He received the 1980 George Axelby Award from the IEEE Control Systems Society and the 2006 Leonard Abraham Prize from the IEEE Communications Society.

LIN AWARD FOR INNOVATION

Min Wu (ECE/ISR/UMIACS), in collaboration with Avinash Varna (ECE Ph.D. 2011), Ravi Garg (EE Ph.D. 2013), and Adi Hajj-Ahmad (current ECE Ph.D. candidate), has received a 2016 Jimmy Lin Award for Innovation. This award, named and endowed for the late ECE professor Jimmy Lin, recognizes an outstanding innovation that has been awarded a U.S. patent in the last fiscal year.

Wu's patent, for environmental signatures for forensic analysis and alignment of media recordings, mirrors her research interests in

George Corcoran Awards Honor Difference Makers in the ECE Department

Five ECE faculty and staff members have been recognized in 2016 with Corcoran and Lin awards for their contributions to education, support, and research. These awards, each named for a late professor, honor those who go above and beyond to make ECE an enriching and efficient experience for its administrators, faculty, students, and staff.

Faculty Award for Significant Contributions to Electrical and Computer Engineering Education

Behtash Babadi (ECE/ISR), the recipient of the Corcoran Award for teaching, has been honored for his outstanding contributions to engineering education and teaching at the University of Maryland. The award is given for significant contributions to electrical or computer engineering through excellence in teaching and the advancement of the profession.

A letter of support for Babadi stated, "He has won an NSF CAREER Award and has served on many Ph.D. and M.S. thesis committees. His success in teaching is remarkable. He has taught three different courses and received excellent student evaluations of his teaching ... [Babadi] has clearly made an outstanding start to his career at Maryland and already deserves the recognition of the Corcoran award."

Babadi, a 2014-2015 distinguished dissertation fellow, received his NSF CAREER award this year in support of his research interests. Babadi joined ECE in Spring 2014 after completing postdoctoral work the Department of Brain and Cognitive Sciences at the Massachusetts Institute of Technology and the Department of Anesthesia, Critical Care and Pain Medicine at Massachusetts General Hospital.

Staff Service Award for Service and Dedication to the Department of Electrical and Computer Engineering

Victoria Berry S.A., the business manager of the A. James Clark School of Engineering's Electrical and Computer Engineering Department, and Joseph Kselman, a technician for the Clark School, have received 2016 Corcoran Staff Service Awards. These awards were given in recognition of their level of dedication, excellence in performance, and commitment to service to the department this year. Their work in support of ECE has allowed others to turn their full attention toward their primary responsibilities, be they teaching, learning, or working behind the scenes.

A letter written in support of Berry's nomination said, "I think that she deserves this award as a recognition of her effort to improve the efficiency of the department. She is always on target."

In support of Kselman's nomination, a recommendation stated, "Joe

information security and forensics and multimedia signal processing and communications.

Wu has been a UMD faculty member since 2001. She received, with highest honors, a B.E. degree in electrical engineering and a B.A. degree in economics from Tsinghua University, Beijing, China, in 1996. Her M.S. and Ph.D. degrees in electrical engineering were award by Princeton University in 1998 and 2001, respectively.

has demonstrated the highest level of dedication to the mission of our department." $\hfill\blacksquare$

Graduate Teaching Assistant Award

Andrew Berkovich and Sheng Cheng have received this year's Corcoran award for graduate teaching assistants (TAs). This award is given to students who show excellent leadership skills and commitment to education in their teaching assistant positions.

In support of Berkovich, a letter said, "Andrew has demonstrated exceptional teaching abilities ... [he has] served in the TA training and development program in the ECE Department, where he developed and delivered workshops to other ECE TAs and provided mentoring for other TAs in ECE."

Of Cheng, a recommendation stated, "[Cheng] is certainly one of the best TAs that I have ever had. One thing that stands out is that he writes up detailed (and excellent) notes for the recitation sections, including solutions to additional problems, and posts them for the students."

Graduate Teaching Assistant Award

Tiecheng Zhu is the recipient of this year's Corcoran award for graduate student service. This award is given to nominees who demonstrate a firm commitment to the welfare of the department and of the students studying within it. Zhu is currently the president of the ECE Graduate Student Association (ECE GSA).

A recommendation written on behalf of Zhu said, "He was very welcoming toward the new graduate students, which allowed us to get to know other students in the department. He is also the first to turn up at the weekly academic seminars ... [he] has really made life for graduate students easier by being meticulous in his work and by being a great friend to all of us."

The Jimmy H.C. Lin Invention Competition Award

Drs. **Rajeev Ranjan**, a research scientist in ECE, and **Vishal Patel**, a former assistant research scientist and now an assistant professor in the Department of Electrical and Computer Engineering at Rutgers, have won UMD's Invention of the Year award for "Hyperface: A Deep Multi-Task Learning Framework for Face Detection, Landmark Localization, Pose Estimation, and Gender Recognition," their contribution to the advancement of face detection technology. Drs. Patel and Ranjan will also be awarded ECE's Lin Invention Competition Award, named for ECE's late Professor Dr. Jimmy H.C. Lin.

Hyperface offers an algorithm for facial recognition software that simultaneously recognizes faces in images and identifies gender, facial poses, and facial landmarks. Identifying these characteristics in photos using current algorithms is often difficult, and the researchers anticipate that the new algorithm will be used in digital cameras, mobile device security, social networks, security cameras, and forensic analysis.

research NEWS

Researchers at UMD Make Breakthrough in Terahertz Technology

A University of Maryland research team, in collaboration with Monash University and the United States Naval Research Laboratory, has invented a tunable large area hybrid metal-graphene terahertz detector. This innovation offers a critical step toward practical graphene terahertz optoelectronic devices.

Graphene, an extremely conductive and two-dimensional lattice of pure carbon, has unique electronic and optical properties. It is especially useful in terahertz range, the part of electromagnetic spectrum between microwaves and infrared light, because the free electrons in the material oscillate collectively at these frequencies. The resonance frequency can be tuned by applying an electric voltage at the gate, allowing the resonator to be adjusted and making it usable in many applications. The research team includes **Thomas Murphy**, professor of Electrical and Computer Engineering and director of the Institute for Research in Electronics and Applied Physics (IREAP); ECE graduate student **Mehdi Jadidi**; United States Naval Research Laboratory researcher **D. Kurt Gaskill; Michael Fuhrer**, research professor in the Department of Physics and the Center for Nanophysics and Advanced Materials and professor of physics at Monash University in Australia; **Andrei Sushkov**, assistant research scientist in the Department of Physics and the Center for Nanophysics and Advanced Materials; and **H. Dennis Drew**, research professor in the Department of Physics and the Center for Nanophysics and Advanced Materials; and **H. Dennis Drew**, research professor in the Department of Physics and the Center for Nanophysics and Advanced Materials.

GRADUATE STUDENTS AREA OF FUNDING

Approximately 56 new graduate students joined the Department of Electrical and Computer Engineering this fall. Students attending our programs are from the USA, South Korea, India, China, Taiwan, Greece, Iran, Bangladesh, Saudi Arabia, Sri Lanka and Turkey. Our American students join us from Connecticut, Maryland, Nevada, New Jersey, New York, Pennsylvania and Washington.

Our 18 Masters students and 38 Ph.D. students have chosen to specialize in the following research areas:



ECE STUDENTS AND FACULTY BREAKING GROUND IN NEW JETLAG RESEARCH

A University of Maryland-authored research paper mathematically modeling the response of circadian neurons in the brain to eastward and westward cross-time-zone trips is making waves in both the research and the media communities.

Authored by Edward Ott (ECE/PHY), Thomas Antonsen (ECE/ PHYS/IREAP), and Michelle Girvan (PHYS); graduate student Zhixin Lu (who is advised by Ott); and non-UMD, National Science Foundation-sponsored undergraduates **Steven** Lee and Kevin Klein-Cardeña, the paper investigates the asymmetrical effects of eastward and westward jetlag. Entitled "Resynchronization of Circadian Oscillators and the East-West Asymmetry of Jet Lag," the paper explores the reasons why recovery from jetlag resulting from eastward travel typically takes longer than recovery from westward travel.

"We model the dynamics of the circadian clock in response to travel, starting at the level of the individual coupled oscillators and then making use of a reduction of this microscopic model to a low dimensional macroscopic description," say the authors of their process, which involved sending fictitious travelers on international trips that covered a steadily increasing amount of time zones. Jetlag occurs when a traveler's circadian rhythm is disrupted; the scientists found that this disruption is easier to overcome when traveling westward.

Their research has been a popular topic of coverage in both the national and international media, with stories in many publications including *The New York Times, The Washington Post, CNN, Travel + Leisure, Marie Claire, Popular Mechanics, Alaturka,* and *The Daily Mail.*

UMD Inventors Zoom In on Camera Technology

Researchers from the A. James Clark School of Engineering's Department of Electrical and Computer Engineering have created a new video camera that excels in capturing video footage in greatly varying brightness conditions.

The True High-Dynamic Range Single Lens Video Camera is the work of Professor of Electrical and Computer Engineering **Christopher Davis** and Department of Electrical and Computer Engineering (ECE) alumnus assistant research engineer **John Rzasa** (B.A. & B.S. '05, M.S. '07, Ph.D. '13), in partnership with **J. Keith McElveen**, president and founder of Wave Sciences Corporation in South Carolina. The camera uses a single lens to simultaneously record three images that capture varying light profiles, significantly reducing blur and greatly enhancing the quality of the image. The team was inspired to invent a new kind of video camera after noticing that their regular cameras did not capture goodquality video footage in settings with uneven lighting.

The camera was nominated by UMD's Office of Technology Commercialization for the Invention of the Year award (Physical Sciences category) at the Celebration of Innovation, part of the University of Maryland's "30 Days of EnTERPreneurship."

GOMEZ' TEAM PATENT HAS FAR REACHING IMPACT ON CANCER DETECTION TECHNOLOGIES

Each year the Center for Advancing Innovation, part of the National Institutes of Health, holds a Nanotechnology Start up Challenge in Cancer (NSC2). This is a contest that develops start-up companies based on inventions that are conceived by scientists from NIH in alliance with other institutions. Inventions that can help with the detection and treatment of cancer are used by participants of the competition to form startup companies to aid in the fight against cancer. Professor and Associate Chair for Undergraduate Education in ECE, R. D. (Mel) Gomez and his team have played a major role in this challenge. Four of the ten winners of NSC2 used the technology they invented. "It is nice that our work has gone beyond scientific publications and into potentially important solutions to real world problems. It is very gratifying," says Gomez.

Gomez and his team conceived "an apparatus containing microarray binding sensors for gene expression and nucleic acid binding assays." The technique allows electronic detection of DNA or RNA sequences or genes. Two fundamental characteristics of nucleic acids are exploited, specifically highly precise complementary binding between two strands and the intrinsic charge of one electron per nucleotide. An array of carbon nanotube transistors acts as a very sensitive electrical sensor to detect the presence and relative concentration of a specific gene in an assay. Gomez has obtained a U.S. Patent and European patents in France, Germany, Ireland, and Great Britain for this technology.

NARAYAN'S RESEARCH ON SAMPLING RATE DISTORTION

Prakash Narayan (ECE/ISR) is currently the principal investigator for a three-year, \$500,000 NSF Communication and Information Theory grant.

The objective is to sample a small subset of a large number of correlated signals and process the sampled signals so as to be able to reconstruct, with tolerable loss, all of the signals from the selected samples. Applications arise in dynamic thermal management for onchip temperature control during runtime; network function computation; image restoration, surface reconstruction, and visual integration in computer vision; and machine learning algorithms.

The research has three main components: an integrated analysis of sampling and rate distortion behavior and their tradeoffs, sampling rate distortion theory for Markov random fields, and sampling rate distortion performance for signals with memory. Expected outcomes are a characterization of fundamental performance limits of optimum sampling rate and lossy compression rate and their interplay, together with the best choice of sampling mechanisms and attendant processing for reconstruction.

The approach devised by Narayan's team involves the development of a principle of "sampling rate distortion." It has the larger objective of elucidating material connections between sampling and rate distortion performance. The performance of specific deterministic and random sampling schemes -- without and with memory in sampling -- and signal processing and estimation schemes are being investigated. Results to date quantify and suggest algorithms to establish how random sampling can outperform fixed sampling schemes and how memory in sampling can be exploited in a structured way to improve performance.

student NEWS

UMD's Student-Run Technica and Bitcamp Hackathons Look to Expand Their Offerings After Successful 2015

University of Maryland students will lead and host two successful hackathons in both 2016 and 2017: the women-only Technica and the co-ed Bitcamp. During these events, small groups collaboratively created or built projects of their choice: anything from mobile apps to software programs was fair game.

Technica, the 24-hour hackathon, kicked off its first annual event last fall and is looking to continue the success this November 5 and 6th at the Reckord Armory. The hackathon hosted over



400 young women from around the country and encouraged them to advance and expand their interests in computer science. Attendees were not just computer science and engineering students: over 150 of the participants were declared majors in subjects such as biology, art, business, and psychology. The workshops held at last year's event, which covered hardware, design, and software programming languages, were aimed at an audience that was new to coding.

In 2016, Technica is looking to expand its event; during the week leading up to the hackathon, workshops and talks will be offered daily to give both attendees and non-attendees the chance to learn more skills.

Bitcamp, the 36-hour hackathon that was founded in 2014, occurs every April. Students of all majors, interests, and backgrounds have come to the event to learn new skills, explore new topics, and create (new) final products. Bitcamp's "camping" theme is encapsulated by the large (fake) campfire at the center of the venue; this has served as a place for lively discussion, wellearned coding breaks, and even a cup-stacking challenge. Last year, a group of participants from Texas and New Jersey ended up meeting at the campfire and deciding to collaborate on the creation of a Web application that visualizes stocks with music.

Bitcamp's goals for this year include intensifying the relationship between hackers and sponsors in order to create an experience that more closely parallels a work environment. This will allow participants to connect more deeply with the sponsors and to be able to envision what a coding job would entail.

UMD-Led Team Advances in SpaceX Hyperloop Pod Competition

A University of Maryland-led team is one of the 22 student teams selected to advance in SpaceX's Hyperloop Pod Competition. The UMD team includes three ECE students. The advancing teams were selected during the competition's Design Weekend held January 29 and 30, 2016, on the Texas A&M University campus. More than 115 student teams from around the world presented their pod design plans and were judged on a variety of criteria, including innovation and uniqueness of design, full Hyperloop system applicability and economics, level of design detail, strength of supporting analysis and tests, feasibility, and quality of documentation and presentation. The final competition will take place January 27 to 29, 2017.

Mentored by Noah Ryder, a research associate with the UMD Department of Fire Protection, the multidisciplinary team includes more than 25 students from UMD's A. James Clark School





of Engineering and College of Computer, Mathematical, and Natural Sciences, as well as several students from Rutgers University; these students are heading up the team's electronics system efforts. "Working on the Hyperloop has taught me the value of real world engineering," said Kyle Kaplan, a team member and a rising junior majoring in aerospace engineering. "The things we are doing here, as undergraduates, are far and beyond what I thought we were capable of just one year ago. Sometimes you need to step outside the classroom to realize that you have what it takes to be an engineer."

The selected teams are headed to California this summer to test their design prototypes on the world's first Hyperloop Test Track during competition weekend. SpaceX, the company sponsoring the competition, is led by CEO and founder Elon Musk.

ECE Graduate Students Win Coveted Wylie Fellowships: Chongxi Bao and Andrew Berkovich

Chongxi Bao and **Andrew Berkovich**, graduate students in the Department of Electrical and Computer Engineering, have been awarded Ann G. Wylie Dissertation Fellowships for the 2016-2017 academic year, a prized University of Maryland award. The fellowship carries a stipend of \$10,000, plus a candidacy graduate school tuition award for the semester in which the fellowship is taken.



Bao's research addresses the current historical moment. "Hardware attacks pose great danger on security-critical systems. For example, reports show that microprocessors in the Syrian radar might have been purposely fabricated with a hidden 'backdoor' inside," he said. "Many cryptographic chips widely used in financial systems have also been broken. To mitigate

these hardware attacks and enhance hardware security, various techniques during the design, fabrication, and testing phase



of these electronic devices are needed." His Ph.D. thesis is entitled Design and Verification Techniques for Enhancing Hardware Security.

Berkovich, who received a B.S. as an undergraduate ECE student, is conducting research in the field of low light vision sensors. Specifically, he is working with low-light vision

sensors to support autonomous navigation and flight stabilization for mini UAVs, with the eventual goal of enabling small UAVs to operate under dark or near-dark conditions. Berkovich has been active in his fields, giving one lecture at ISCAS in each of the past three years (2014-2016) and authoring numerous conference and journal papers. In 2015, he was recognized for his service to ECE with an ECE Graduate Student Service Award. He was recently recognized for his accomplishments with a Graduate Student Summer Research Fellowship (awarded by the Graduate School) and an NSA Electrical Engineering Student Scholarship.

ECE Students Named PES Scholarship Plus Scholars

Four undergraduate electrical engineering students have received IEEE Power and Energy Society's Scholarship Plus Initiative awards.

The students, **Kelly Fernandez**, **Justin Kelman**, **Tony Zhang**, and **Xiao Xi Zhang**, received one-year grants from PES for their electrical engineering studies. Their selection was based on their academic performances, pursuit of activities in the electrical engineering field, and the strength of ECE's electrical engineering program. Awardees can apply to renew their scholarships every year until graduation and are expected to maintain their academic performance and broaden their exposure to the field through work experience outside the classroom.

The Scholarship Plus program is open to applicants from the United States, Canada, and Puerto Rico, with a separate initiative open to students in India.

alumni NEWS



ECE Inducts Five New Distinguished Alumni

The Department of Electrical and Computer Engineering (ECE) recently inducted the 2016 class of distinguished alumni. Amr Adly, Patrick Antkowiak, J. Gary Eden, Eytan Modiano, and Radha Poovendran were nominated by ECE professors and selected and approved by departmental committees.

Three honorees were recognized at a ceremony and luncheon on May 13, 2016. The remaining honorees will be recognized as speakers for the engineering community at the University of Maryland.

Amr Adly In 1992, Amr Adly received his Ph.D. in electrical engineering from the University of Maryland under the supervision of Professor Isaak Mayergoyz. He was recognized for his leadership in the areas of power and electrical machines, electromagnetics, and superconductivity, as well as his contributions to the field of electrical engineering and scientific research in Egypt. His award was presented by Mayergoyz.

After completing his education, he worked as a magnetic measurement instrumentation senior scientist at LDJ Electronics in Michigan. In 1994, he became a faculty member at Cairo University, while continuing to work with Mayergoyz as a visiting researcher at the University of Maryland during the summers of 1996 to 2000. He established and directed the R&D division at the Egyptian Industrial Modernization Center from 2006 to 2007, where he directed a 20-million-dollar fund to boost knowledge-based added value in national industries.

Adly served as Cairo University's faculty of engineering vice dean of education and student affairs (2010 to 2012) and vice dean of graduate studies and research (2012 to 2014). From 2014 to 2015, he was the executive director of the Science and Technology Development Fund (STDF), the main R&D funding agency in Egypt. In January 2016, he was appointed vice president for graduate studies and research at Cairo University. Adly has published more than 120 reviewed papers, has received a United States patent, has served IEEE in a number of capacities, and has supervised more than 15 Ph.D. and M.S. students. He has been recognized with various prizes and honors, including elevation to IEEE fellow in 2011. Adly currently serves as associate editor for *IEEE Transactions on Magnetics* and *Elsevier's Journal of Advanced Research*. **Patrick Anthowiak** graduated with a M.S. degree in electrical engineering from the University of Maryland in 1998. Anthowiak will serve as a speaker in the A. James Clark School of Engineering Whiting-Turner Lecture Series this fall.

Antkowiak is currently the corporate vice president and chief technology officer for Northrop Grumman, where he is responsible for developing and executing corporate technology strategy and working closely with all sectors to develop technology plans. He serves as the lead corporate executive for interfacing with technology leaders among customers, industry partners, and university research partners. Antkowiak also chairs the CTO Council and plays a key role in support of the capture, development, and retention of technical talent within Northrop Grumman.

Antkowiak was previously the vice president and general manager of the Advanced Concepts and Technologies Division in the Electronic Systems sector, where he had executive



responsibility for all advanced product development and technology programs, activities, and operations. In 2009, he was appointed to the vice presidency of Engineering, Manufacturing and Logistics Strategy and Capability, where he was responsible



for the development and implementation of product development roadmaps and technology strategy. While serving as director of space systems in the Advanced Concepts & Technologies Division, he was responsible for the development of radio frequency and

electro-optical space sensor and space superiority concepts and technologies for future Department of Defense and intelligence programs.

J. Gary Eden Born and raised in Maryland, J. Gary Eden developed an interest in electrical engineering at young age as an amateur radio operator. Eden received his bachelor's degree in electrical engineering from the University of Maryland in 1972 and his master's and doctorate degrees from the University of Illinois at Urbana-Champaign in 1973 and 1976, respectively.

He returned to Maryland in 1975 to serve as a National Research Council postdoctoral research associate in the Naval Research Lab (NRL). From 1976 to 1979, Eden worked as a research physicist in the Optical Sciences Division of NRL, where he co-discovered the first proton beam-pumped laser. He received the Research Publication Award from NRL.

In 1979, Eden returned to the University of Illinois and continued to research laser physics, molecular and ultrafast laser spectroscopy, photonics, and the science of microcavity plasmas. He served as assistant dean in the College of Engineering, associate dean of the Graduate College, and associate vice chancellor for research. Currently, Eden is the Gilmore Family professor of electrical and computer engineering and is an affiliate faculty member in the Departments of Bioengineering, Materials Science and Engineering, and Nuclear, Plasma, and Radiological Engineering.

Eden has authored more than 300 technical publications and has been awarded 75 patents. He is a fellow of the IEEE, the American Physical Society, the Optical Society of America, the AAAS, and the SPIE. He is currently the associate editor of the *Applied Physics Reviews (AIP)* and a member of the Editorial Board of Scientific Reports. His awards include the OSA C.E.K. Mees Medal and the IEEE Photonics Society Aron Kressel Award. He was elected to the National Academy of Engineering and the National Academy of Inventors in 2014. Eden has also fostered his talents in industry as the co-founder of both Eden Park Illumination and EP Purification. He was honored as a distinguished alumnus by Professor Christopher Davis, his colleague in the optics field.

Eytan Modiano received his M.S. and Ph.D. degrees in electrical engineering from the University of Maryland

in 1989 and 1992, respectively. He is being recognized for his leadership in the networking, satellite communications, optical communications, and wireless sensor systems fields. Modiano will deliver one of the fall 2016 lectures in the Distinguished Colloquium Series in Electrical and Computer Engineering hosted by Booz Allen Hamilton. His research concerns communication network protocols with an emphasis on satellite, wireless, and optical networks.

He has been a faculty member at MIT since 1999, serving as a professor in the Department of Aeronautics and Astronautics and the Laboratory for Information and Decision Systems (LIDS).

Previously, he was a Naval Research Laboratory fellow and a National Research Council postdoctoral fellow. He also worked with MIT Lincoln Laboratory.

Modiano was co-recipient of the Sigmetrics 2006 Best Paper Award and the WiOpt 2013 Best Paper Award. He has served as an editor for leading industry journals, such as the *IEEE/ ACM Transactions on Networking* and *IEEE Transactions on Information Theory*. He was the technical program co-chair for a number of conferences, including IEEE WiOpt 2006 and DRCN 2015. Modiano is an IEEE fellow, an associate fellow of the AIAA, and a member of the IEEE fellows committee.

Radha Poovendran In 1999, Radha Poovendran received his Ph.D. in electrical engineering from the University of Maryland. Currently, he is the chair of the Department of Electrical Engineering at the University of Washington, where he is also a professor and the founding director of the Network Security Lab (NSL). Poovendran was recognized at the May luncheon for ECE distinguished alumni, where he was honored for his seminal contributions to the security of wireless communication and sensor networks and cyberphysical systems, as well as to the foundations of the science of security. His research interests include the areas of wireless and sensor network security, adversarial modeling, privacy and anonymity in public wireless networks, control-security, gamessecurity and information theoretic-security in the context of wireless mobile networks.

Poovendran has been a recipient of awards including the NSA LUCITE Rising Star Award (1999), and PECASE (2005) for his research contributions to multi-user wireless security. He was also a recipient of the Outstanding Teaching Award and Outstanding Research Advisor Award from UW EE (2002). He co-authored five best papers, with commendations including the IEEE PIMRC Best Paper Award (2007 and the AIAA/ IEEE Digital Avionics Systems best session paper award (2010 and 2012), and the WiOpt Best Paper Award (2012). He was named a Kavli Fellow of the National Academy of Sciences (2007). He co-edited a book titled Secure Localization and Time Synchronization in Wireless Ad Hoc and Sensor Networks and served as the chief editor for the Proceedings of the IEEE special issue on cyber-physical systems (2012). He currently edits IEEE TMC and ACM TOSN. Poovendran is also a founding member and the associate director of research in the University of Washington Center for Excellence in Information Assurance Research and Education.

Alumni Awards and Honors

ECE Alums' Cyber Risk Start Becomes Part of *FICO*

FICO, the company associated with providing credit rating scores, has purchased QuadMetrics, a cyber risk startup company led by alumni **Mingyan Liu** (MSSE 1997; EE Ph.D. 2000) and **Manish Karir** (EE B.S. 1996; EE M.S. 1999), as well as **Wesley Huffstutter**.



The company, licensed from the University of Michigan in 2015, leverages predictive analytics in order to monitor signals from open source and proprietary data sources and provide an overall security score for an enterprise. This score helps security professionals address gaps and sheds

light on a firm's security risk.

"We have built a system using state-of-the-art Internet measurement and predictive analytics techniques to enable quantitative security risk assessment ... ours is the only predictive solution currently on the market," said Liu, QuadMetrics's chief science officer and a professor of electrical engineering and computer science at the University of Michigan.

The educational backgrounds of Liu and Karir laid the foundation for their company's success. While a student at Maryland, Liu was advised by Professor John Baras (ECE/ISR) and Professor Andre Tits (ECE/ISR). Karir was also advised by Baras for his M.S. degree and worked on security of Internet over satellite protocols.

Leonard to be Honored for Cooperative Control Innovations

Naomi Ehrich Leonard, an alumna of the University of Maryland A. James Clark School of Engineering, was honored for her research in the field cooperative control of autonomous vehicles at the annual Innovation Hall of Fame induction ceremony on November 9, 2015.

Leonard was among the first to investigate the simple rules that enable individual agents—whether living organisms or robotic vehicles—to work together in groups by coordinating decisionmaking, sensing, and motion. In her early work, through the forces of attraction, repulsion, and alignment, the agent's responsive rules achieved the desired moving group formation.

She led a multidisciplinary team in an effort to develop adaptive and sustainable ocean observing systems using the coordinated motion

of a fleet of autonomous underwater gliders. She is also inspiring investigation at the intersection of engineering and art, as co-creator of Flock Logic, an art-making project that explores what happens when dancers carry out the rules used to model flocking birds.



Leonard received a B.S.E. degree in

mechanical engineering from Princeton University in 1985. She earned M.S. and Ph.D. degrees from the University of Maryland's Department of Electrical and Computer Engineering in 1991 and 1994, respectively, with a major in control theory and a minor in communication theory. She is a fellow of the Institute for Electrical and Electronics Engineers, the American Society of Mechanical Engineers, the Society for Industrial and Applied Mathematics, and the International Federation of Automatic Control.

ECE Graduates Look to Matchmake Between Developers and Young Entrepreneurs

For twin brothers **Tommy** (EE B.S. 2016) and **Taylor Johnson** (EE B.S. 2016), the "severe disconnect" between aspiring entrepreneurs and developers represented opportunity. Ideas abounded among their classmates, but outlets to bring them to their full realization were lacking.

Thus VentureStorm, their company (founded with current undergraduate **Tyler Denk**), was launched. VentureStorm is a non-technical platform that matches entrepreneurs in very early stages of their plans with developers looking for projects. The service was carried out in person until a Web site was launched in 2015.

In its current version (3.0), a "freemium" model is used. While developers can use the site for free and message entrepreneurs

with appealing projects, the entrepreneurs pay a fee to gain access to contacting developers.

The Johnsons and Denk hope that their new model will allow them to successfully monetize the site. They are already seeing growth in their project scope; VentureStorm recently coordinated its first sixfigure offer (up from a usual scope of \$5,000-\$10,000 per project just five months before).

The founders have said that VentureStorm is also crucial to young workers due to its ability to get them into the working world. The site's access to developers and projects could lead to new work experiences and help to make them more marketable to full-time employers down the road.

Alumnus Jack Craig Reaches New Heights with Art

Jack Craig (B.S. 2001, M.S. 2003) has always been fascinated by building things in new ways and seeing the results. These days, he's applying his engineering skills to an unconventional field: art. He creates his furniture forms and sculptures in his Detroit studio, or as he calls it, his "testing ground."

"I've strayed from engineering in its strictest sense, but I would still quantify what I'm doing now in the same way," he says. "You are developing a new process that is completely undefined. The forms could be anything, which is both maddening and exhilarating. From there it's about fleshing out the possibilities. It's a series of explorations that flex and diminish aspects of the form language."

His path to the art world was indirect. After graduating from the University of Maryland, he worked in the infrared division of the United States Navy. He returned to school to pursue a bachelor's degree in industrial design, which he obtained from the University of Illinois in 2010. He also earned a master's degree in fine arts – 3D design – from the Cranbook Academy of Art in 2012.

Craig's recent works include the PVC Series, which comprises furniture forms developed from heating and hand manipulating large sections of PVC water mains, and work in bronze. In the latter series, Craig uses bronze brazing rods that he melts with a welding torch.

Would Craig ever formally return to the engineering field? "I love what I do, but never say never," he says. "If I ever go back to engineering, I would hope it would be in a capacity that straddles both disciplines." His ECE education will ensure his success in either of these different, yet similar, fields.



Alumnus Jie Chen Wins Canada's Killam Award

Jie Chen (ECE M.S. 1992, Ph.D. 1998), currently a full professor in the Department of Electrical and Computer Engineering at the University of Alberta, was a recipient of a 2015 Killam Annual Professorship Award. This award, established in 1991, is one of the most prestigious awards granted to professors at Canadian universities. The award recognizes faculty members based on the quality of their scholarly and teaching activities and for the substance of their contributions to the community outside the university.

Chen, who is also a research officer at the Canadian National Research Council/National Institute for Nanotechnology (NINT), conducts research in these three areas: designing and micro/

nanofabricating portable impedance-based microfluidic pointof-care biosensors (one of the Internet-of-Things); developing pulsed wave therapeutic instruments (forming dental tissues, removing scars, repairing meniscus, alleviating depression); and building functional nanomaterials for targeted drug delivery and genetic modified agricultural products. He has received numerous awards, including an IEEE fellowship and the Canada Foundation for Innovation (CFI) Leaders' Opportunity Award from the Canada Foundation for Innovation. His research on designing miniaturized ultrasound device for intra-oral dental tissue formation was listed by Reader's Digest as a major medical breakthrough in Canada in 2006.

donor spotlight



ViaSat, Inc., is looking to develop its relationship with the Department of Electrical and Computer Engineering even further in 2017, with research a top priority for both the company and the Department.

The company, which became a corporate affiliate of ECE in 2013, has a strong presence. It is a fixture at the annual ECE Career Fair, sponsored two undergraduate research fellows in 2015-2106 (with plans for two more during the 2016-2017 school year), and features a strong internship program. Last year's undergraduate research fellows worked on the porting of the company's Network Control Centre and modifying their Network Management Software. ViaSat has also hosted tech talks, been a part of panel discussions, spoken in undergraduate classes, and held lobby days, where staff members set up a table in the lobby of the A.V. Williams Building.

ViaSat is a global broadband services and technology company. With more than 3,800 employees, the company is focused on connecting "international communities to the Internet by offering high-speed satellite-based residential Internet service; by enabling passengers and operations crews to stream high-bandwidth media, applications, and content when traveling globally on commercial, business or government aircraft or maritime vessels; and by empowering international warfighters on the front lines of battle with real-time, secure Internet-based intelligence, surveillance, and reconnaissance for high-requirement missions." The company serves consumer, commercial and government customers worldwide. ViaSat's headquarters are located in Carlsbad, CA, and the company maintains a large presence in Maryland with offices in both Germantown and Baltimore.



Professor Jimmy H.C. Lin was a well-loved and longtime member of the Electrical and Computer Engineering Department faculty, and his impact is as strong as ever today.

The generosity of the Lin family has helped ECE create cuttingedge learning experiences for its students. In 2015, a gift from the family allowed the department to begin the process of fully overhauling the Undergraduate Circuits Design Lab. The lab, course ENEE 307, will be renamed the Jimmy Lin Circuits Design Lab. Lin, who used to teach this course, will be present in another way, as some of the experiments will be using his patents. Construction on the lab began in summer 2016, and the lab will be in use for students in fall 2016.

This gift is just the latest one to ECE to help it grow and modernize. In 2008, Lin himself created the Jimmy Lin Fund for Innovation and Invention. A prolific inventor, Lin wanted to support the Innovation Award. This honor was intended to help ECE students and faculty with all aspects of the invention and patenting process. The yearly award provides assistance with moving ideas forward through the complicated and often expensive act of patenting.

After Lin's death in 2009, his wife, Anchen Lin, established a new endowment in his honor. Her gift in 2011 created the Jimmy Lin Endowment for Entrepreneurship; this fund provides annual awards to students and faculty who transform their ideas into innovations through invention, internships, and technology commercialization. Honors include the Jimmy H. C. Lin Invention Award and the Jimmy H. C. Lin Entrepreneur Internship Award, which allows Chinese students to work at Chinese start-ups in Maryland during the summer. At the same time, an additional fund was established to support four electrical engineering Ph.D. students each year at Lin's alma mater, National Chiao Tong University in Taiwan. The Lin family also allowed ECE to refurbish a premier conference room in the A. James Clark School of Engineering. Anchen Lin passed away in April 2016, but this couple's legacy lives on in ECE.









2015/2016!

A LOOK BACK











A. JAMES CLARK SCHOOL OF ENGINEERING Department of Electrical and Computer Engineering 2455 A.V. Williams Building University of Maryland College Park, MD 20742

Nonprofit Org. U.S. Postage PAID Permit No. 10 College Park, MD

ECE EXPRESSES SINCERE THANKS FOR THE FOLLOWING CORPORATE AFFILIATES WHO WILL SUPPORT OUR STUDENTS AND RESEARCH IN 2015-2016:





WE NEED YOUR HELP!

To learn how you can make a charitable contribution today and have a measurable impact on the future of the Electrical and Computer Engineering Department, or to explore other options, contact Amanda Stein, ECE Director of External Relations.

steina@umd.edu | 301-405-8189